

## Frequency Agile OPO-based Transmitters for Multiwavelength DIAL\*

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### Oral Presentation

The simultaneous extraction of accurate concentrations of multiple species, or the concentration of a single species in the presence of a complex, fluctuating background, requires the extension of traditional two-line DIAL techniques to multiple wavelengths. Until recently, the only transmitters capable of pulse-to-pulse wavelength agility over a wide frequency band were based on the grating tuned CO<sub>2</sub> laser, and thus were restricted to operation on a fixed line set determined by the lasing gas. In this paper we report on the development of frequency agile, *all solid state* laser transmitters which have pulse-to-pulse frequency agility at kilohertz repetition rates, with continuous or near-continuous access to arbitrary frequencies within a wide spectral range in the mid-infrared.

Three advances in fundamental laser technology underpin the development of these transmitters: multiwavelength seed sources which use volume phase holograms and spatial light modulators to disperse and spectrally filter the output of low power, mode-locked laser oscillators; kilohertz repetition rate, high beam quality Nd:YAG oscillators/amplifiers made possible by high power diode pump arrays and phase conjugation; and rapidly tunable OPOs based on noncollinear phasematching and acousto-optic pump angle deflection.

These technologies have been implemented in a mid-Infrared LIDAR transmitter which we have recently field tested. The system permits the probing of narrow absorption features and their backgrounds within a  $\approx 2 \text{ cm}^{-1}$  window, while spectra of wide band

absorbing species can be taken over a  $\approx 200 \text{ cm}^{-1}$  region with a frequency agile OPO. The system is designed to operate at maximum repetition rate of 1 kHz.

Key words: Frequency agile, solid state, multiwavelength LIDAR

Biography:

Stephan P. Velsko, Anthony Ruggiero, and Mark Herman are staff scientists at Lawrence Livermore National Laboratory responsible respectively for OPO, multiwavelength seeder, and diode pumped solid state laser development for active remote sensing systems.

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